

Sensors

Advanced Gas Sensors and High-Temperature Pressure Sensors

For in situ leak detection, emissions monitoring, and pressure measurements

NASA's Glenn Research Center have developed advanced hydrogen and hydrocarbon gas sensors capable of detecting leaks, monitoring emissions, and providing in situ measurements of gas composition and pressure. These compact, rugged sensors can be used to optimize combustion and lower emissions and are designed to withstand harsh, high-temperature environments (e.g., silicon carbide (SiC) sensors can operate at 600 C). NASA Glenn is actively seeking industrial partners to cooperatively develop and apply these cutting-edge sensor systems in new applications.

BENEFITS

- ➔ Rugged - functions in environments where conventional sensor systems are inoperable
- ➔ Low cost - emissions sensors can replace more expensive gas measurements systems; high-temperature SiC pressure sensors can eliminate the need for cooling
- ➔ Versatile - can be used in a range of configurations, including wireless and Lick and Stick sensor systems
- ➔ Responsive - high-temperature SiC pressure sensor enables high-frequency pressure measurements in combustion environments
- ➔ Easy to install - Lick and Stick leak detection system can be applied wherever safety information is needed

technology solution

NASA Technology Transfer Program

Bringing NASA Technology Down to Earth

THE TECHNOLOGY

NASA Glenn Research Center, in conjunction with academia and industry, has developed a range of microelectromechanical systems (MEMS)-based and SiC-based microsensor technologies that are well suited for many applications. The suite of technologies includes (1) hydrogen and leak detection sensors; (2) emissions sensor arrays; and (3) SiC high-temperature pressure sensors.

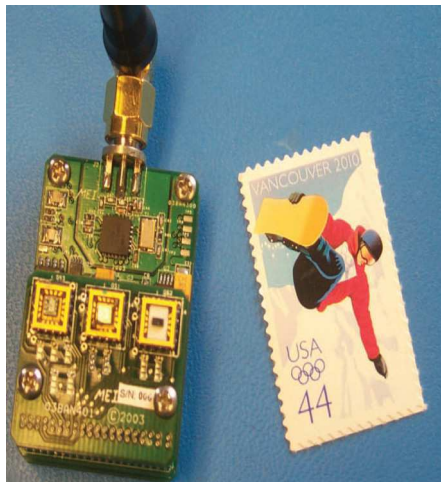
The hydrogen and leak detection sensors are currently being used to protect astronauts on the International Space Station, and they have many Earth-based applications as well. They can function as a single-sensor unit or form part of a complete smart sensor system that includes multiple sensors, signal conditioning, power, and telemetry. Sensors for hydrocarbons (such as methane), oxygen, temperature, and pressure can be included in the array.

The emissions sensor array has high sensitivity and stability and provide gas detection at temperatures ranging from at least 450 to 600 C. The gas sensing structure detects various combustion emission species (carbon monoxide, carbon dioxide, oxygen, hydrocarbons, and nitrogen oxides) over a wide range of concentrations.

The SiC high-temperature pressure sensor can operate at temperatures as high as 600 C, whereas standard pressure sensors are temperature-limited. This sensor has been successfully used in NASA combustion rigs to detect combustion instabilities. It is well suited for in-cylinder pressure measurements for automotive engines.



SiC pressure sensor and pressure response of sensor at temperatures as high as 610 C (following 1100 hr of high-temperature testing).



Lick and Stick leak detection system provides self calibration and ready installation.

APPLICATIONS

The technology has several potential applications:

- ➔ Leak detection for hydrogen-powered vehicles
- ➔ Rapid inspection of valve and seal integrity
- ➔ Storage tank headspace monitoring
- ➔ System health monitoring
- ➔ Engine emissions monitoring and control
- ➔ Industrial process monitoring
- ➔ Safety monitoring
- ➔ Alarms for high-temperature pressure vessels and piping
- ➔ Fire detection and environmental monitoring
- ➔ High-frequency pressure measurements in combustion environments, for example, in-cylinder pressure measurements

PUBLICATIONS

Patent No: 7,518,234; 6,845,664; 6,291,838; 7,389,675; 8,052,854; 8,877,636; 8,001,828

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